

REMARKS

Applicants acknowledge and respectfully express thanks to Examiner Helen Pratt for the interview graciously granted on February 26, 2004, at which time agreement was reached as to entry of an amendment substantially the same¹ as presented above, and the patentability of the present invention. Present at such interview were Examiner Pratt, Mr. N. Ben-Yehuda, the first named inventor, and undersigned attorney of record. Attached is a copy of the "Interview Summary" prepared by Examiner Pratt.

Upon entry of the present amendment, the claims in the application will be only new claims 84-102, the previously pending claims being canceled. As agreement has been reached, applicants respectfully request officially favorable consideration, entry of the amendments presented above, and early formal allowance.

The new claims emphasize the treatment of potatoes, and call for inhibiting the sprouting of potatoes. Support appears throughout applicants' specification and can be found, for example, in line 6 of claim 1 (amended) as it appeared in the Reply filed January 15, 2003, with potatoes having been called for previously in claims 45 and 64, for example.

¹ There are some minor charges, including new dependent claims 92, 95-98 and 101.

The maximum pH of 6, and preferably 4 (new claim 85) can be found for example at page 21 of applicants' specification, third paragraph from the bottom. This same paragraph also provides support for the specified acids. Nitric acid was previously recited in original claim 14.

Support for the metallic ions is also found in various locations including page 21, second paragraph from the bottom as well as original claims 9-12. As regards the quantity of metallic ions, support for the range set forth in claim 84 is found for example in original claim 7, and support for the narrower range of claim 86 is to be found in the second paragraph on page 19 of applicants' specification.

Support for the terms "dry fog", "fumes" and "smoke" is to be found in original claims 40-42. Also, claim 42 provides support for the minimum particles size of the microdroplets whereas original claim 34 provides support for the maximum size of the microdroplets. The maximum particle size of the microdroplets as recited in claim 88 is to be found in original claims 39 and 40; and for claim 92 in original claim 37.

Maintaining a high relative humidity is to be found, for example, in the second paragraph on page 20 of applicants' specification.

Fogging, as recited in claim 89 and 90, was previously called for in claims 79, 28 and 50-53.

The concentration of hydrogen peroxide as recited in claim 91 was previously called for in original claim 4 and is also found in the first paragraph on page 19 of applicants' specification.

Support for the length of storage as called for in claims 93 and 98 is found in line 4 of example 1 on page 22; and for claims 95 and 97 in example 18.

Intermittent treatment as called for in claims 93-98 is found in several locations including examples 1 and 2, with support for the intervals as called for in claims 93 and 95 being found in examples 19 and 20; also see original claims 3 and 4. The percentage recited in claims 97 and 98 is formed in example 1.

The temperature as recited in claims 94 and 96 can be found in example 19, line 4 of the first paragraph thereof.

Continuous treatment as called for in claim 99 appears in line 2 of original claim 5.

Claim 101 adds explicitly an inherent feature that the claimed process also inhibits rooting, support being found for example in the paragraph spanning pages 13 and 14 and in the preamble of original claim 1.

Claim 102 is directed to the treatment of seed potatoes which is mentioned several times in applicants' specification, an important objective being to break epical dominance. For example, please see the fifth paragraph on page 11 of applicants' specification; line 4 of page 15; line 3 of page 17 and examples 17-11 and 18-20 on page 23-26.

Claims 61-83 were rejected under the first paragraph of §112. As applicants propose to delete these claims by amendments presented above, applicants need not reply to this rejection².

Claims 61-83 were rejected as obvious under §103 from Martin in view of Gomori. In addition, claims calling for the particle size of the microdroplets were similarly rejected as obvious under §103 from Martin in view Dalmasso. These rejections are respectfully traversed.

As noted above and in the "Interview Summary", agreement has been reached that the prior art does not make obvious applicants' invention as claimed above. However, to complete the record, applicants note as follows;

New main claim 84 focuses on inhibiting sprouting of

² For the record, however, applicants believe that the phrase "free of hydrogen peroxide stabilizers" as that term is used in Gomori, appearing in applicants' claims 61 and 81, is supported by the examples.

potatoes, which is an unobvious result. The applied prior art says nothing of inhibiting the sprouting of potatoes. Indeed, at least to some extent, the prior art suggested that the application of hydrogen peroxide to potatoes would "enhance sprout growth", noting the attachment from "Sprout Master". Applicants have flown in the face of the Sprout Master teaching and have highly surprisingly achieved exactly the contrary result, namely inhibition of sprouting of the potatoes. This is the antithesis of obviousness.

An important aspect of the present invention is the application of the hydrogen peroxide solution in the form of a dry fog, fumes, or smoke of microdroplets having a particle size of 0.001 to 100 microns. The microdroplets, not a vapor, contain not only the hydrogen peroxide itself, but also the acid and the metallic ions, and are persistent even at very high humidities, e.g. 95% plus, without any condensation of the stored potatoes. The following text appears in the second paragraph on page 20 of applicants' specification:

The application of the solution in the form of ultrasmall drops by solution atomizing systems that produce "dry" fogs..., has been found to provide particularly beneficial results. These include compensation for or prevention of water loss, inhibition of sprouting,... [The microdroplets] facilitate the achievement of very high relative humidity, i.e., even as high as 99% +, without any condensation on the stored matter. Furthermore, the small particles show a very high penetrability into small

cracks and spaces. As a consequence, even when the potatoes are stored in ordinary stacks or sacks, the "dry" fog storage has a high degree of penetrability and accessibility to all points in the stack or sack. This means that even in the simplest and most space compact facilities, stored plant matter, such as potatoes and similar items, can be effectively treated to prevent weight loss due to dehydration as well as softening and other deteriorative processes brought about by an inadequate humidity environment.

The importance of the microdroplet sizes is thus made clear in applicants' specification.

Neither Martin nor Gomori show anything similar.

The previous rejection relied upon Dalmasso, but Dalmasso is fundamentally deficient. First, Dalmasso produces a hydrogen peroxide **vapor**, i.e. a gas rather than microdroplets. Of course, Dalmasso does not suggest the incorporation of metallic ions, and applicants doubt that the Dalmasso vapor, i.e. a gas, could include the metallic ions which are essential according to the present invention. Thus, Dalmasso and Gomori are inconsistent and cannot be reasonably combined without the destruction of one or the other and a consequent further deviation from anything similar to the present invention.

Moreover, Dalmasso has a further contrary teaching to what is required according to the present invention. As noted during the aforementioned interview, and as pointed out

at column 2, line 44 of Dalmasso, the Dalmasso sterilization system includes "dehumidification", a feature entirely contrary to the present invention. Thus, any incorporation of Dalmasso would by necessity result in a process not only different from, but also inconsistent with the present invention.

Accordingly, it is clear that applicants' claims define nonobvious subject matter over the prior art, and that the rejection should be withdrawn as agreed during the aforementioned interview.


Attached is a copy of NZ 298824, an English language equivalent of Fr. 94 15 193, previously made of record. Its disclosure is no better than that of Gomori.

Favorable consideration, entry of the amendment presented above and early formal allowance are earnestly solicited.

Respectfully submitted,

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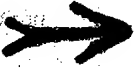
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"The Doctor of the future will give no medicine but will interest his patients in the care of the human frame, in diet and in the cause and prevention of disease"

Thomas A. Edison



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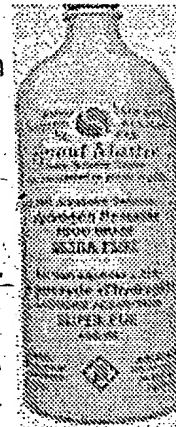
- Kombucha

Hydrogen Peroxide

To ensure purity, our H2O2 is hand bottled on our premises. Each of our operators are certified and licensed in the handling and transporting of this product.

We highly recommend using H2O2 35% Food Grade in any sprouting method. By adding one quarter ounce to the water reservoir, you will enhance sprout growth while eliminating mold.

The makeup of hydrogen peroxide is distilled water with an extra molecule of oxygen attached which formulates $H_2O + O = H_2O_2$. H2O2 destroys micro-organisms 5,000 times faster than chlorine. It is effective against all of the bacteria which chlorine can remove, and exceeds chlorine in neutralizing pathogens, viruses and cysts from protozoa. Unlike chlorine, H2O2 is environmentally friendly because its waste byproducts are only oxygen and water.



WARNING: When using 35% Hydrogen Peroxide avoid contact with skin, eyes and clothing. May cause blindness if splashed in eyes. May cause burns and white spots if splashed on skin. Wash thoroughly after handling.

3% Hydrogen Peroxide Solution: A 3% solution of H2O2 is made by adding one ounce of 35% H2O2 to eleven ounces of purified or distilled water.

Interview Summary

Application No.

09/744,681

Applicant(s)

BEN YEHUDA ET AL.

Examiner

Helen F. Pratt

Art Unit

1761

All participants (applicant, applicant's representative, PTO personnel):

(1) Helen F. Pratt.(3) Ben Yehuda.(2) Mr. Neimark.

(4) _____.

Date of Interview: 26 February 2004.

Type: a) ☐ Telephonic b) ☐ Video Conference
c) ☐ Personal [copy given to: 1) ☐ applicant 2) ☐ applicant's representative]

Exhibit shown or demonstration conducted: d) ☐ Yes e) ☒ No.
If Yes, brief description: _____.

Claim(s) discussed: all.

Identification of prior art discussed: all.

Agreement with respect to the claims f) ☒ was reached. g) ☐ was not reached. h) ☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: claims will be amended to remove Jepson format, to add steps of contacting and sprouting and amended to add the microdroplet minimum size.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.


HELEN PRATT
PRIMARY EXAMINER

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Examiner's signature, if required

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

REGISTER OF PATENTS

Convention Date: 16.12.94
 Priority }
 Claimed

Date of Application
 in New Zealand:

Country: France

Date of Patent: 18.12.95
 (being date on which
 complete specification was filed)

Patentee's Address for Service:

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 NZ

Patent current to: 18.12.99

Renewal fees	Date	Receipt No.	Amount	Renewed to
1st				
2nd				
3rd				
4th				

Patent No. 298824

Date sealed: 11 FEB 1999

Checked by —

Title of invention:

AQUEOUS COMPOSITION CONTAINING H₂O₂, ACIDS AND AG, PREPARATION METHOD THEREFOR AND USE THEREOF FOR DISINFECTION, HYGIENE AND/OR POLLUTION CONTROL

Name, address and
 nationality of Patentee:

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New Zealand No. 298824

International No. PCT/FR95/01690

TO BE ENTERED AFTER
ACCEPTANCE AND PUBLICATION

Priority dates: 16.12.1994;

Complete Specification Filed: 18.12.1995

Classification: (6) A01N59/16; B09C1/08

Publication date: 28 October 1998

Journal No.: 1433

NEW ZEALAND
PATENTS ACT 1953
COMPLETE SPECIFICATION

Title of Invention:

Aqueous composition containing H_2O_2 , acids and AG, preparation method therefor and use thereof for disinfection, hygiene and/or pollution control

Name, address and nationality of
applicant(s) as in international
application form:

SODIFRA, 72, rue Jean Bonal, 92250 La Garenne Colombes, France

AQUEOUS COMPOSITION BASED ON H_2O_2 , ACIDS AND Ag, METHOD
OF PREPARATION AND USE IN THE FIELD OF DISINFECTION,
HYGIENE AND/OR POLLUTION CONTROL

05 FIELD OF THE INVENTION

The present invention relates to an aqueous disinfecting and cleaning composition based on H_2O_2 , acids and Ag; as a novel industrial product.

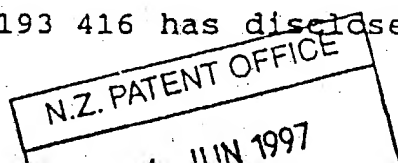
10 It further relates to the method of preparation and to the use of this composition on the one hand in the field of disinfection and/or hygiene, especially for disinfecting or sterilizing hospital and industrial premises, surfaces of various materials, storage containers, pipelines, harvests, foodstuffs and drinking
15 water, and on the other hand in the field of pollution control, especially for controlling pollution in the mining industries (in particular in the prevention of acid mine drainage and the destruction of cyanides in the soil).

20 PRIOR ART

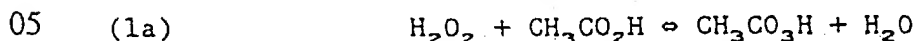
In the field of disinfection, several technical solutions are known which utilize H_2O_2 : some involve an aqueous composition containing H_2O_2 , a percarboxylic acid (RCO_3H , where R is a C_1 - C_2 -alkyl group) and the
25 corresponding carboxylic acid (RCO_2H), and others involve an aqueous composition containing H_2O_2 and silver in the form of a salt or complex.

Thus EP-A-0 370 850 has disclosed an aqueous composition comprising H_2O_2 (6-8% by weight, based on
30 the total weight of said composition), CH_3CO_3H (0.1 to 1% by weight) and CH_3CO_2H (2 to 10% by weight) as a hygiene agent for the disinfection of hemodialysis equipment; this composition can be diluted with water before use.

35 EP-A-0 193 416 has disclosed an aqueous compo-



sition comprising H_2O_2 (1 to 8% by weight), $\text{CH}_3\text{CO}_3\text{H}$ (0.005 to 0.1% by weight) and $\text{CH}_3\text{CO}_2\text{H}$ in the amount necessary to attain the equilibrium of the system according to the following equation:

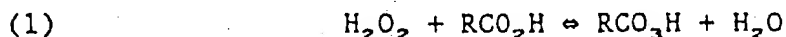


said composition being used for rendering contact lenses aseptic.

10 In its only Example, EP-B-0 087 343 (see top of column 6) has disclosed an aqueous composition comprising H_2O_2 (19.9% by weight), $\text{CH}_3\text{CO}_3\text{H}$ (2% by weight), $\text{CH}_3\text{CO}_2\text{H}$ (6.1% by weight), HNO_3 (8.0% by weight) as a preservative, hydroxyethanediphosphonic acid (0.3% by weight) as a stabilizer and/or corrosion inhibitor, and H_2O (63.7% by weight), this composition being presented
15 as a disinfecting product which is less corrosive towards metals (especially steel) than Javelle water, on the one hand, and the acid $\text{CH}_3\text{CO}_3\text{H}$, on the other.

FR-A-2 321 302 has disclosed an aqueous composition comprising H_2O_2 (25-40% by weight), RCO_3H
20 [and/or RCO_2H] (0.5-20% by weight), phosphonic acid (0.25-10% by weight) and H_2O (to make up to 100% by weight) as a microbicidal product, the molar ratio $\text{H}_2\text{O}_2/\text{RCO}_3\text{H}$ being greater than or equal to 2/1 and preferably between 3/1 and 50/1. The phosphonic acid
25 component present in the aqueous composition according to FR-A-2 321 302 is a hydroxyalkylpolyphosphonic acid, aminoalkylpolyphosphonic acid or polyaminoalkylenepolyphosphonic acid compound or an Na, K, ammonium or ω -hydroxyalkylammonium salt, this phosphonic acid component acting principally as a corrosion inhibitor.
30

It is known that a percarboxylic acid is prepared according to equation (1):



and that, to stabilize concentrated aqueous solutions of RCO_3H , it is recommended, especially by FR-A-2 309

531, FR-A-2 321 301 and EP-A-0 024 219, to incorporate H_2O_2 into said compositions. In practice, in the case of an acid compound RCO_3H in aqueous solution, an aqueous composition is ultimately obtained which comprises a mixture of H_2O_2 , RCO_3H and RCO_2H according to equilibrium equation (1) given above.

US-A-3 035 698, on the other hand, has disclosed an aqueous composition comprising H_2O_2 and Ag^+ ions as a disinfecting product. However, when the hydrogen peroxide in an aqueous mixture of $H_2O_2 + Ag^+$ is concentrated, there is a considerable risk of explosion. To limit this risk, FR-A-2 597 347 envisages a preparative technique which utilizes a strong mineral acid (especially phosphoric acid, nitric acid, hydrobromic acid, hydrochloric acid, sulfuric acid or boric acid) and a stabilizing organic acid (especially tartaric acid, citric acid, maleic acid, malonic acid, 6-acetamidohexanoic acid, hippuric acid or acetoxibenzoic acid).

More precisely, according to FR-A-2 597 347, the method of preparing an aqueous concentrate containing $H_2O_2 + Ag^+$ comprises the following steps:

- mixing a strong mineral acid ($pH < 1.6$) with a silver salt or a silver complex at a temperature of $50-60^\circ C$, the molar ratio strong mineral acid/silver component being greater than or equal to 1;
- cooling the resulting mixture to a temperature of $25-30^\circ C$ and adding a stabilizing organic acid, optionally together with gelatin; and
- incorporating H_2O_2 into the resulting mixture.

The technical solutions of the prior art, which involve an aqueous composition comprising a mixture of $H_2O_2 + RCO_3H + RCO_2H$ or a mixture of $H_2O_2 + Ag^+$, are found to have an inadequate disinfecting effect (bac-

tericidal, fungicidal, virucidal, algicidal or parasiticidal effect). The following has been observed in particular:

05 (a) When aqueous compositions corresponding to said technical solutions of the prior art are sprayed into enclosed spaces containing harmful or undesirable strains, the difference between the decimal logarithm of the concentration of said strains at time $T = 0$ and the decimal logarithm of the concentration of the same
10 strains at time $T = 2$ h is not always greater than or equal to 3 for molds or greater than or equal to 4 for bacteria.

In other words, if $[S]_{T=0}$ is the concentration (number of germs per ml) of a given strain at time $T =$
15 0 and $[S]_{T=2h}$ is that of the same strain at time $T = 2$ h after exposure to a sprayed aqueous composition for 2 h, the technical solutions of the prior art produce a result (ΔR) given by the relationship

(2) $\Delta R = \log_{10}([S]_{T=0}) - \log_{10}([S]_{T=2h})$
20 which is such that, very often,

$\Delta R \leq 3$ for molds, and

$\Delta R \leq 4$ for bacteria.

(b) There are strains, especially strains of *Penicillium verrucosum*, which resist the aqueous
25 compositions of the technical solutions of the prior art comprising a mixture of $H_2O_2 + RCO_2H$ (especially CH_3CO_2H) + RCO_2H (especially CH_3CO_2H) or a mixture of $H_2O_2 + Ag^+$.

As far as pollution control is concerned, it
30 should be pointed out that the mining industry has to deal with two major environmental problems: (i) leaching (solubilization) of the metals contained in the soils, due to acid drainage and common to all types of mine, and (ii) contamination of the soils by the
35 cyanides originating particularly from the technique of

gold extraction in gold mines and gold works.

05 Numerous minerals and metals present in mine
soils, such as arsenic, selenium and aluminum, can be
solubilized and can end up in the subterranean waters
and the environment due to acid drainage. The acid
drainage of rocks is the result of natural oxidation of
the sulfur-bearing ores following their exposure to air
and water! These oxidation reactions are often accele-
10 rated by certain microorganisms. The chemical and
biological reactions cause a lowering of the pH of the
water, which then has the property of mobilizing any
heavy metal which may be present in the rock residues.
If sufficient water is available, it will act as a
vehicle and the resulting drainage may contain the
15 products of the acid generation process, typically
appreciable amounts of Al, Ca, Si, Mg, Na, K, Fe, other
metals and sulfates. This phenomenon causes a negative
impact on the quality of the water infiltrating into
the environment. By way of example, as sulfur-bearing
20 ores are present throughout the Canadian Shield and in
coal mines, the leaching of metals is a very widespread
problem in the Canadian mining industries.

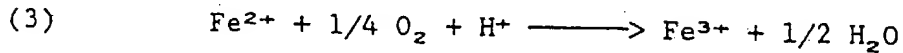
Acid generation is the result of a complex
process involving a large number of chemical reactions.
25 These reactions can be simply illustrated by the
following example of the oxidation of pyrites (FeS_2),
which is one of the most common sulfur-bearing ores.

The first important reaction is oxidation of
the sulfur-bearing ore to ferrous iron, sulfate ions
30 and hydrogen (H^+):

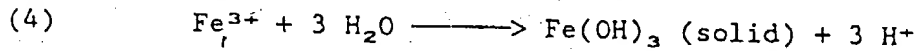


The dissolved iron, the sulfates and the
hydrogen cause an increase in the concentration of
total dissolved solids and an increase in the acidity
35 of the water. The rise in acidity is associated with a

drop in pH. If the neighboring environment is sufficiently oxidizing, most of the ferrous iron will be oxidized to ferric iron (Fe^{3+}):



At low pH, the ferric iron will precipitate in the form of $\text{Fe}(\text{OH})_3$, leaving only a little Fe^{3+} in solution and lowering the pH at the same time:



Any Fe^{3+} ion formed in equation 3 and not precipitated in equation 4 can be used to oxidize more pyrites:



On the basis of these simplified reactions, acid generation, where ferric ions are formed and subsequently precipitated as $\text{Fe}(\text{OH})_3$, can be summarized by combining equations 2, 3 and 4:



Certain bacteria are found to be capable of accelerating several of reactions 2-5, increasing the acid generation rate by a factor of up to 5. Among these bacteria, strains of *Thiobacillus ferrooxidans* are known to accelerate reactions 2, 3 and 5. It is known that *Thiobacillus ferrooxidans* is particularly involved in the oxidation of pyrites and that it is capable of accelerating the oxidation of the sulfides of As, Cu, Cd, Co, Ni, Sb, Mo, Pb and Zn, thereby increasing the rate or degree of solubilization of these metals. Thus the presence of oxidized arsenic (AsO_4^{3-}) in the environment is due to the solubilization of sulfur-bearing ores such as arsenopyrite, realgar, orpiment, cobalite and niccolite. There is therefore a need to prevent acid generation (and hence metal leaching and sulfate formation) by influencing the bacteria, such as *Thiobacillus ferrooxidans*, involved in the oxidation of sulfides.

Furthermore, in the processes for the extraction of metals such as gold, the release of toxic cyanides into the mining residues and the waste waters represents a major environmental problem. The waste waters can be purified by chemical oxidation of the cyanides they contain using an oxidizing agent such as H_2O_2 or SO_2 . On the other hand, nothing is currently being done to treat the soils containing cyanides - the gold mining industry is content for the cyanides to be destroyed by natural atmospheric oxidation mechanisms. There is therefore an urgent need in this area to clean the soils containing cyanides.

OBJECT OF THE INVENTION

According to a first feature of the invention, it is proposed to provide a novel technical solution which makes it possible to overcome the aforementioned disadvantages of the technical solutions of the prior art. This novel technical solution involves an aqueous composition comprising a mixture of H_2O_2 + RCO_2H + RCO_2H + Ag^+ , said mixture making it possible to obtain, especially by spraying into an enclosed space, a ΔR value greater than 3 for molds and greater than 4 for bacteria after exposure for 2 h.

According to a second feature of the invention, it is proposed to provide, according to said technical solution, an aqueous decontaminating (i.e. disinfecting and/or cleaning) composition comprising a mixture of H_2O_2 , RCO_2H (where R is ethyl or, preferably, methyl), RCO_2H (where R is defined as indicated above), Ag (in the form of a salt or complex as a source of Ag^+ ions) and H_3PO_4 , in which the four components hydrogen peroxide, percarboxylic acid, carboxylic acid corresponding to said percarboxylic acid and Ag^+ have a synergistic effect in respect of the disinfecting and cleaning properties.

According to a third feature of the invention, it is proposed to provide a method of preparing said aqueous decontaminating composition.

05 According to yet another feature of the invention, it is proposed to use said aqueous decontaminating composition (i) for disinfecting and/or "cold-sterilizing" in particular, or sterilizing at room temperature (10-25°C), enclosed spaces (hospital, agricultural, industrial, household or transport premises),
10 surfaces of various materials, instruments, storage containers, liquid pipelines, foodstuffs and drinking water, and (ii) for cleaning mining sites in order to prevent acid generation and/or to destroy the cyanides (by oxidation).

15 SUBJECT OF THE INVENTION

According to the novel technical solution of the invention, an aqueous decontaminating composition is recommended, said composition, which contains H_2O_2 and a silver component in an acid medium, comprising
20 (A) an amount of H_2O_2 less than or equal to 60% by weight, based on the total weight of said composition;
(B) an RCO_2H/RCO_2H mixture, where R is methyl or ethyl, said mixture being present in an amount such that
25 the weight ratio of said mixture to the hydrogen peroxide is between 0.15/1 and 0.85/1;
(C) a silver component as a source of Ag^+ ions, selected from the group consisting of silver salts and complexes, said silver component being present in
30 an amount such that the weight ratio of said silver component to the hydrogen peroxide is between 0.0005/1 and 0.015/1;
(D) a stabilizer present in an amount such that the
35 weight ratio of said stabilizer to the hydrogen peroxide is between 0.0005/1 and 0.025/1; and

water to make up to 100% by weight.

The method of preparing said aqueous decontaminating composition according to the invention comprises steps consisting in

- 05 (1°) preparing an aqueous solution of the silver component which is present as a source of Ag^+ ions;
- (2°) introducing the stabilizer into said resulting solution obtained in this way;
- 10 (3°) introducing said resulting solution obtained in this way into the hydrogen peroxide solution or introducing the hydrogen peroxide solution into said resulting solution;
- (4°) introducing, into said resulting solution obtained in this way, an acid substance selected from the group consisting of RCO_3H , RCO_2H and mixtures thereof, i.e. $\text{RCO}_3\text{H} + \text{RCO}_2\text{H}$;
- 15 (5°) leaving said resulting solution obtained in this way until the equilibrium $\text{H}_2\text{O}_2 + \text{RCO}_2\text{H} \rightleftharpoons \text{RCO}_3\text{H} + \text{H}_2\text{O}$ has been established; and
- 20 (6°) making up to 100% by weight with water.

The use of the aqueous decontaminating composition according to the invention as a disinfecting product comprises

- 25 (i) a surface or volume treatment of the product to be disinfected or decontaminated, at a temperature of between 0°C and 50°C , preferably at room temperature (RT) within the range 10°C to 25°C , with said aqueous disinfecting composition, optionally diluted, and then
- 30 (ii) if appropriate, drying of said product treated in this way.

The use of said aqueous composition as a cleaning product comprises step (i) above, the drying of step (ii) taking place of its own accord at room temperature.

35 The product to be disinfected comprises espe-

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cially enclosed spaces (particularly hospital, agricultural and industrial premises), surfaces of various materials, instruments, storage containers, pipelines (especially pipelines for aqueous liquids such as water, milk, beer and fruit juice), foodstuffs, harvests, outdoor or greenhouse crops and drinking water.

The product to be cleaned consists especially of soils and waste heaps in the mining industry.

DETAILED DESCRIPTION OF THE INVENTION

Hereafter, unless indicated otherwise, the respective amounts of the ingredients of the aqueous decontaminating composition according to the invention are expressed in % by weight and the dilutions of said composition are expressed as the ratio initial volume/volume of the resulting diluted composition.

In general terms, the aqueous decontaminating composition according to the invention has an H_2O_2 content which is less than or equal to 60% by weight, based on the weight of said composition. For said aqueous composition, the lowest antibacterial dose tested corresponds to a final dilution of $5/10^7$ (containing 0.000025% by weight of H_2O_2); at this dose, the composition according to the invention provides antibacterial protection for at least 48 h (in the field of balneotherapy).

Consequently, in the vast majority of cases, the present invention recommends a composition which comprises 0.1 to 60% by weight of H_2O_2 and which can be diluted at the appropriate time during use.

Hydrogen peroxide presents difficulties as regards transportation when using hydrogen peroxide solution with a high H_2O_2 content, for example an H_2O_2 content greater than 16% or 8% by weight, depending on the regulations in several countries. If, from a practical point of view, it is advantageous to use

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hydrogen peroxide solution containing 50 to 70% by weight of H_2O_2 as a starting material, the aqueous disinfecting composition according to the invention should preferably have an H_2O_2 content which is less than or equal to 8% by weight, so as to avoid special vented packaging to comply with the national regulations for restricting transport, said packaging requiring qualified personnel to use it.

In practice, the aqueous decontaminating composition according to the invention will have an H_2O_2 content of the order of 7.5-8% by weight and will be diluted with water, at the time of use, down to a final H_2O_2 concentration particularly of between 0.0000025 and 4% by weight.

As a variant, it is possible to market an optionally prediluted, aqueous disinfecting or cleaning composition which is stabilized and contains 1.5 to 8% by weight of H_2O_2 , is ready to use and retains its efficacy for at least two years.

In practice, the aqueous decontaminating composition according to the invention will advantageously contain 7.5 to 8% by weight of H_2O_2 and, if appropriate, will be diluted with H_2O by the user.

The respective amounts of RCO_3H and RCO_2H in the RCO_3H/RCO_2H mixture are not critical. Given equilibrium reaction (1) above, it suffices to have either H_2O_2 and RCO_3H or H_2O_2 and RCO_2H together in H_2O in order to produce a ternary mixture of $H_2O_2 + RCO_3H + RCO_2H$, provided that H_2O_2 is in excess relative to the RCO_3H/RCO_2H pair. It therefore suffices, as it were, to incorporate

(i) RCO_2H in the presence of H_2O_2 , or

(ii) RCO_3H (which, in the concentrated state, generally contains H_2O_2 and RCO_2H according to documents FR-A-2 321 301 and FR-A-2 321 302 cited above)

into H_2O in order to produce the combination of $H_2O_2 + RCO_3H + RCO_2H$ in equilibrium.

05 In the aqueous decontaminating composition according to the invention, the weight ratio of the RCO_3H/RCO_2H mixture to the hydrogen peroxide is between 0.15/1 and 0.85/1. In practice, this weight ratio will advantageously be between 0.5/1 and 0.7/1.

10 In general terms, the CH_3CO_3H/CH_3CO_2H pair (i.e. $R = \text{methyl}$) is preferred to the $CH_3CH_2CO_3H/CH_3CH_2CO_2H$ pair (i.e. $R = \text{ethyl}$) since the first pair is more active than the second as a disinfecting/cleaning means in the aqueous composition according to the invention.

15 In increasing order of preference, the recommended silver component will be a silver complex, a silver salt with an organic acid (especially CH_3CO_2Ag) or a silver salt with a mineral acid (especially Ag_2SO_4 and preferably $AgNO_3$).

20 Silver oxides, Ag_2O and AgO , are unsuitable because they are not water-soluble. If Ag_2O and/or AgO were used, it would be necessary firstly to solubilize them with a relatively large amount of a strong base ($NaOH$ or KOH) and then to increase the initial amounts of the RCO_3H/RCO_2H mixture (component B above), on the one hand, and those of the acid stabilizer (component D above), on the other, so as (α) to neutralize the strong base and (β) to have the required amounts of components B and D in the aqueous decontaminating composition.

30 In the aqueous decontaminating composition according to the invention, the weight ratio of the silver component to the hydrogen peroxide is between 0.0005/1 and 0.015/1. In practice, this weight ratio will advantageously be between 0.0008/1 and 0.005/1 and preferably of the order of 0.001/1.

35

The stabilizer, which is present (i) to protect the H_2O_2 and the Ag^+ ions during the preparation of the aqueous decontaminating composition according to the invention and avoid any risk of explosion, especially from concentrated solutions of H_2O_2 and Ag^+ , and (ii) to preserve the required concentrations between H_2O_2 , CH_3CO_2H and Ag^+ in said composition until it is used, is selected from the group consisting of mineral and organic acids. The most effective of these acids are strong mineral acids, the most valuable here being H_3PO_4 , which is very particularly preferred.

In the aqueous decontaminating composition according to the invention, the weight ratio of the stabilizer to the hydrogen peroxide is between 0.0005/1 and 0.025/1. In practice, this weight ratio will advantageously be between 0.0008/1 and 0.005/1 and preferably of the order of 0.001/1.

According to the invention, it is recommended advantageously to use the stabilizer in an amount which is substantially identical to or slightly greater than that of the silver component.

The aqueous disinfecting composition according to the invention can also contain at least one component selected from the group consisting of

- (E) a surfactant;
- (F) a corrosion inhibitor; and
- (G) a fragrance.

The surfactant used here is (i) an ionic or non-ionic surface-active compound suitable in particular for contact with foodstuffs and, if appropriate, suitable for oral administration with drinking water at the use dose in question, or (ii) a mixture of such compounds.

Among the products suitable for this purpose, particular mention may be made of alkylbenzenesul-

fonates, alkylsulfates and alkanesulfonates of alkaline earth metals and (preferably) alkali metals (particularly Na or K), as well as polyethoxylated phosphoric acid alkyl esters and mixtures thereof.

05 In the aqueous decontaminating composition according to the invention, the weight ratio of the surfactant to the hydrogen peroxide is between 0.00005/1 and 0.01/1. In practice, this weight ratio will advantageously be of the order of 0.005/1.

10 It is recommended to incorporate a corrosion inhibitor into the aqueous decontaminating composition according to the invention, said corrosion inhibitor, at the dose use, being suitable for contact with food-stuffs and/or for oral administration with drinking
15 water. As corrosion inhibitors which can be used for this purpose, particular mention may be made of the aminophosphonic acids described in FR-A-2 321 302 cited above, their sodium, potassium, ammonium and alkanol-
20 amine salts and mixtures thereof. Hydroxyethanediphosphonic, dimethylaminomethanediphosphonic and ethylenediaminetetrakis(methylenephosphonic) acids, their Na, K, NH_4^+ or alkanolamine salts and mixtures thereof are particularly suitable for the aqueous decontaminating composition according to the invention. 1,2,3-Benzo-
25 triazole is also suitable as a corrosion inhibitor.

In practice, the corrosion inhibitor will be present at a low concentration in the aqueous decontaminating composition according to the invention. When present, said corrosion inhibitor will be used
30 especially in an amount such that the weight ratio of said corrosion inhibitor to the hydrogen peroxide is between 0.00005/1 and 0.03/1 and preferably between 0.001/1 and 0.005/1. As the aqueous decontaminating composition according to the invention contains cor-
35 rosive acid substances, namely RCO_2H , RCO_2H and the

05 stabilizing acid component of item D (H_3PO_4), it is important to limit the corrosion so that the corrosion rate of steel or copper articles subjected to 200 immersion cycles in the aqueous decontaminating composition according to the invention, followed by drying (without rinsing), or to 200 spraying cycles with said composition, followed by drying at 15-35°C (oven or stream of purified air; without rinsing with water), is less than 50 $\mu m/year$.

10 In fact, as the corrosion of metal surfaces is principally the result of a phenomenon called "pitting", it is essential to avoid the formation of said pits, where the germs which it is desired to eradicate would reside and develop.

15 The fragrant component of item (G) will be used in the aqueous decontaminating composition in an amount which is less than or equal to that of the corrosion inhibitor of item (F).

20 The water which forms part of the decontaminating composition according to the invention is advantageously a purified water, namely distilled water, demineralized water or, preferably, deionized water. Here the deionized water will preferably be a water having a resistivity greater than $10^5 \Omega/cm$ and preferably greater than $10^6 \Omega/cm$.

25 The water optionally used to dilute said decontaminating composition according to the invention will advantageously be purified water as indicated above.

30 The pH of the aqueous composition according to the invention (before use) is generally between 1.5 and 4. It is regulated by means of the preferred component D, H_3PO_4 .

35 The aqueous decontaminating composition which is particularly recommended comprises

- (A) 1.5 to 8% by weight of H_2O_2 ;
(B) 0.75 to 5.6% by weight of a mixture of RCO_2H and RCO_2H , where R is ethyl or, preferably, methyl;
05 (C) 0.0012 to 0.04% by weight of a silver component selected from silver complexes and salts as a source of Ag^+ ions;
(D) 0.0012 to 0.04% by weight of H_3PO_4 ;
(E) if appropriate, 0.0075 to 0.04% by weight of surfactant;
10 (F) if appropriate, 0.003 to 0.04% by weight of corrosion inhibitor;
(G) if appropriate, a fragrance; and
water (distilled, demineralized or deionized) to make up to 100% by weight.

15 A stock solution with an H_2O_2 content of the order of 7.5-8% by weight is recommended more particularly. This stock solution contains

- (A) 7.5-8% by weight of H_2O_2 ;
20 (B) 4.5 to 4.8% by weight of a mixture of CH_3CO_2H + CH_3CO_2H ;
(C) 0.008% by weight of $AgNO_3$;
(D) 0.008% by weight of H_3PO_4 ; and
water (distilled, demineralized or deionized) to make up to 100% by weight.

25 Said stock solution is then used

- either as such or diluted with purified water to an H_2O_2 content of 1.5 to 4% by weight;

- or complemented with components (E), (F) and/or (G) and then, if necessary, diluted with purified water to an H_2O_2 content of 1.5 to 4% by weight;

30 - or complemented with mixture (B) of CH_3CO_2H + CH_3CO_2H until the content of said mixture in the aqueous decontaminating composition is 5.6% by weight, the resulting composition then being diluted with purified water as indicated above, if necessary;

- or complemented on the one hand with mixture (B) and on the other hand with components (E), (F) and/or (G), and then, if appropriate, diluted with water as indicated above.

05 When the preparative method referred to above in the section "Subject of the invention" is carried out, steps (1°) and particularly (2°) to (4°) and (6°) are performed with stirring. In practice, steps (3°) and (4°) are carried out at a temperature less than or
10 equal to 30°C and preferably at a temperature less than or equal to 25°C, and step (2°) is carried out at a temperature less than or equal to 60°C.

In step (1°), the source of Ag⁺ ions will preferably be AgNO₃. In step (2°), a concentrated
15 aqueous solution of phosphoric acid, in particular a commercial solution containing 85% by weight of H₃PO₄, may be used as the stabilizer.

In step (3°), hydrogen peroxide solution with an H₂O₂ content greater than 8% by weight and less than
20 or equal to 70% by weight is used; either the solution obtained in step (2°) is introduced into said hydrogen peroxide solution, or said hydrogen peroxide solution is introduced into the solution obtained in step (2°); each of these introductions is carried out slowly
25 (especially at a rate of 1 to 5 liters of solution introduced in 20-60 minutes), with stirring and with cooling to a temperature less than or equal to 30°C and preferably to a temperature less than or equal to 25°C.

In step (4°), the acid substance (RCO₃H, RCO₂H or the mixture of RCO₃H + RCO₂H) is introduced into the
30 solution obtained in step (3°), under the same conditions as in said step (3°) as regards the introduction rate, temperature and stirring.

In step (5°), the solution obtained in step
35 (4°) is left to stand for about 48 h at a temperature

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less than or equal to 30°C and preferably at a temperature less than or equal to 25°C, so that the equilibrium of equation (1) is established. Step (5') is advantageously carried out in the dark.

05 As indicated above, the water used to prepare the aqueous decontaminating composition according to the invention, especially in steps (1') and (6'), is purified water, i.e. distilled, demineralized or deionized water.

10 Components (E), (F) and/or (G) are introduced in appropriate manner between step (1') and step (6'). As a variant, each of these ingredients can be incorporated at the end of step (6').

15 The aforementioned stock solution containing 7.5-8% by weight of H_2O_2 is prepared by a particular method which comprises steps consisting in

(1') preparing a solution of $AgNO_3$ in part of the total amount of water required to produce said aqueous disinfecting composition;

20 (2') introducing, into the resulting solution obtained in this way, an aqueous solution of phosphoric acid containing 85% by weight of H_3PO_4 ;

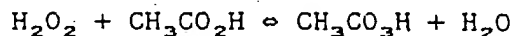
25 (3') introducing the resulting solution obtained in this way into an aqueous solution of hydrogen peroxide containing 50 to 60% by weight of H_2O_2 , with stirring, at a temperature of between 0°C and 25°C and preferably at a temperature of between 4°C and 15°C, and with introduction of the solution obtained in step (2') at a rate of between 3 and 6 l/h;

30 (4') introducing the acid substance CH_3CO_2H into the resulting solution obtained in this way, with stirring, at a temperature of between 0°C and 25°C and preferably at a temperature of between 4°C and 15°C, and with introduction of the acid substance

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CH₃CO₂H at a rate of between 3 and 6 l/h;

(5°) leaving the resulting solution obtained in this way to stand for 48 h, in the dark, at a temperature of between 0°C and 25°C and preferably at a temperature of between 4°C and 15°C, so that the equilibrium



is established; and

(6°) adding the remaining water to make up to 100% by weight.

In step (4°) of the preparation of the stock composition, the acid can be introduced in the form of an aqueous solution.

When the aqueous decontaminating composition according to the invention is employed as a disinfecting composition, as is generally the case, it is used (i) as prepared, or (ii) at a rate of at least 5 ml of said composition for a volume of 1 m³ or surface of 1 m² to be treated, said composition being diluted if appropriate.

As regards the use of the aqueous composition according to the invention as a disinfectant, the following is more particularly recommended:

(α) immersion of the product to be treated (which has advantageously been washed beforehand) in an aqueous decontaminating composition containing 1.5 to 4% by weight of H₂O₂;

(β) spraying of an aqueous disinfecting composition containing 2 to 4% by weight of H₂O₂ onto a surface to be treated (this is the case of outdoor crops) at a rate of 5 to 20 liters of said composition per hectare;

(γ) spraying of an aqueous disinfecting composition containing 2 to 8% by weight of H₂O₂ into a volume to be treated (this is the case of food harvests in

silos) at a rate of 0.5 to 4 liters of said composition per m^3 ; or

- 05 (d) incorporation of an aqueous disinfecting composition containing 16 to 50% by weight of H_2O_2 into the water to be treated (this is the case particularly of swimming pool water or drinking water) at a rate of 5 to 150 ml of said composition per 1 m^3 of water to be treated (5 to 150 ml corresponding to a final use concentration of 0.00008% by weight to 0.0075% by weight of H_2O_2); in particular, for 10 the disinfection of drinking water, about 20 ml/ m^3 will be used (i.e. a final use concentration of the order of 0.001% by weight of H_2O_2).

15 The aqueous disinfecting composition according to the invention is especially useful for:

(a) the disinfection and hygiene of hospital premises and industrial premises (milk dairies, cheese dairies, malt houses, breweries, greenhouses, cowsheds, hen houses, stables, packaging lines for foodstuffs, 20 drinks or drugs, interiors of aeroplanes and boats) and the contents of said premises, especially the equipment or instruments equipping said premises or used therein;

(b) the disinfection and hygiene of storage containers (especially silos) and pipelines for conveying liquid or solid products such as foodstuffs 25 (sugar, tea, coffee, cereals, drinks);

(c) the disinfection and hygiene of swimming pools and the contents of the aforementioned storage containers and pipelines;

30 (d) the disinfection of drinking water; or

(e) the protection of outdoor crops (cereals, tomatoes, forests, banana plantations, orchards, etc.), by virtue of its bactericidal, fungicidal, sporicidal, virucidal and antiparasitic properties.

35 When employed as a cleaning composition, the

composition according to the invention is used either by being sprayed into the volume to be treated or onto a surface of said volume, or else by being stirred in.

05 In practice, the starting composition, like the aforementioned stock composition, will contain 7.5 to 8% by weight of H_2O_2 and will be diluted before use to a final use dilution of less than 1/100 (preferably a dilution of 5/1000 to 5/10,000 and particularly preferably of 1/1000).

10 The cleaning composition according to the invention is mainly effective in mining sites, especially for eliminating or substantially reducing (i) acid generation (particularly from sulfur-bearing ores) and (ii) cyanides (particularly in the case of gold mines
15 and gold extraction plants).

Best mode

The best mode of carrying out the invention consists in using a stock composition which, as indicated above, contains

- 20 (A) 7.5-8% by weight of H_2O_2 ;
(B) 4.5 to 4.8% by weight of a mixture of CH_3CO_2H + CH_3CO_2H ;
(C) 0.008% by weight of $AgNO_3$;
(D) 0.008% by weight of H_3PO_4 ; and
25 distilled, demineralized or deionized water to make up to 100% by weight.

This stock composition is then complemented with components (E), (F) and/or (G) mentioned above and, if appropriate, components (B), (C) or (D).

30 Other advantages and characteristics of the invention will be understood more clearly from the following description of practical Examples and comparative experiments. Of course, these data taken as a whole do not in any way imply a limitation but are
35 given by way of illustration.

In these experiments, the "IP" strains used are those which were supplied by the Collection Nationale de Cultures de Microorganismes (CNCM) administered by the Institut Pasteur in Paris.

05 *Examples 1-5*

The formulations of the Examples (Ex. 1 - Ex. 5) according to the invention, and the formulations of the Comparative Examples according to the prior art without silver component (A1 - A5) or without the RCO₂H/RCO₂H mixture (B1 - B5), have been collated in Table Ia (CH₃CO₂H/CH₃CO₂H pair) and Table Ib (EtCO₂H/EtCO₂H pair) below, composition B4 of Table Ib being identical to that of composition B1 of Table Ia, and the water present in these formulations (not mentioned in said Tables Ia and Ib) representing the amount required to make up to 100% by weight.

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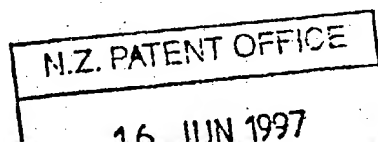


TABLE Ia

Formulations (% by weight) of the ingredients other than the water

Product	H ₂ O ₂	Mixture of CH ₃ CO ₂ H + CH ₃ CO ₃ H	AgNO ₃	H ₃ PO ₄	Surfactant (a)	Corrosion inhibitor (b)
Ex. 1	8	4.8	0.008	0.008	0.04	0.032
A1	8	4.8	-	0.008	0.04	0.032
B1	8	-	0.008	0.008	0.04	0.032
Ex. 2	8	5.6	0.005	0.005	0.04	0.032
A2	8	5.6	-	0.005	0.04	0.032
B2	8	-	0.005	0.005	0.04	0.032
Ex. 3	7.75	4.5	0.002	0.004	0.02	0.02
A3	7.75	4.5	-	0.004	0.02	0.02
B3	7.75	-	0.002	0.004	0.02	0.02
<u>Notes:</u> see Table Ib						

TABLE Ib

Formulations (% by weight) of the ingredients other than the water

Product	H ₂ O ₂	Mixture of EtCO ₂ H + EtCO ₃ H	AgNO ₃	H ₃ PO ₄	Surfactant (a)	Corrosion inhibitor (b)
Ex. 4	8	4.8	0.008	0.008	0.04	0.032
A4	8	4.8	-	0.008	0.04	0.032
B4 (c)	8	-	0.008	0.008	0.04	0.032
Ex. 5	8	5.6	0.01	0.01	0.04	0.032
A5	8	5.6	-	0.01	0.04	0.032
B5	8	-	0.01	0.01	0.04	0.032
<u>Notes:</u> (a): 1/1 (w/w) mixture of sodium alkylbenzenesulfonate and ammonium alkylsulfate (b): 1/3 (w/w) mixture of hydroxyethanediphosphonic acid and dimethylaminomethanediphosphonic acid (c): B4 is identical to B1						

Example 6

A concentration composition according to the invention was prepared which comprised:

	H_2O_2	50%	by weight
05	mixture of $CH_3CO_2H + CH_3CO_3H$	30%	by weight
	$AgNO_3$	0.05%	by weight
	H_3PO_4	0.05%	by weight
	surfactant	0.25%	by weight
	corrosion inhibitor	0.20%	by weight
10	H_2O to make up to	100%	by weight

This composition is diluted to the required H_2O_2 concentration at the time of use.

Example 7

A stock cleaning composition according to the invention was prepared which comprised:

	H_2O_2	7.8%	by weight
	mixture of $CH_3CO_2H + CH_3CO_3H$	4.7%	by weight
	$AgNO_3$	0.008%	by weight
	H_3PO_4	0.008%	by weight
20	surfactant	0.04%	by weight
	H_2O to make up to	100%	by weight

This stock composition is diluted to a final use dilution of less than 1/100 at the time of use.

Analogous compositions A7 and B7 were likewise prepared for comparison, said compositions differing from Ex. 7 only in the absence of $AgNO_3$ (composition A7) or in the absence of the mixture of $CH_3CO_2H + CH_3CO_3H$ (composition B7).

Experiments I

The bactericidal, fungicidal and sporicidal activities of the compositions according to the invention were measured, against the comparative compositions, by spraying according to French Standard AFNOR NF 72 281 (as revised in December 1989) under the following operating conditions:

	Spraying apparatus	AEROBRUMEUR® type H
	Output	16 ml/m ³
	Amount of test product	540 ml
	Diffusion time of the test	
05	product (i.e. composition)	12 minutes
	Experimental enclosure	
	volume,	33 m ³
	temperature	23-24°C
	relative humidity	85% (initial), 80%
10		(final)
	Support	microscope slides for
		bacteriology or
		mycology
	Distance of the support	
15	from the source	1.2 m
	Exposure time of the support	2 h
	Recovery liquid	sterile distilled water
		+ TWEEN® 80 (0.5% by
		weight)
20	Volume of the recovery liquid	100 ml
	Membrane rinsing volume	100 ml
	Number of rinses	3

25 The results obtained have been collated in
 Tables IIa to IIe below, which show the concentrations
 of the test products (i.e. compositions Ex. 1 - Ex. 5,
 A1 - A5 and B1 - B5) after dilution with deionized
 water.

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Strain	(1)	Ex. 1 dilution: 1/5		A1 dilution: 1/5		B1 dilution: 1/5	
		(2)	(3)	(2)	(3)	(2)	(3)
<i>Staphylococcus aureus</i> IP 52 154	1.8×10^6	0	6.25	0	6.25	0	6.25
<i>Pseudomonas aeruginosa</i> IP A22	1.5×10^6	0	6.17	1.9×10	4.90	2.1×10	4.85
<i>Enterococcus faecium</i> IP 5 855	1.6×10^5	0	5.20	10	4.20	9×10	3.25
<i>Mycobacterium smegmatis</i> IP 7 326	1.3×10^5	0	5.11	2×10	3.81	1.9×10	3.84
<i>Candida albicans</i> IP 1180 79	1.9×10^5	0	5.27	1.8×10	4.02	1.5×10	4.10
<i>Penicillium verrucosum</i> IP 1186 79	1.5×10^5	0	5.17	2.3×10^2	2.81	2.7×10^2	2.74
spores of <i>Bacillus subtilis</i> var. <i>Niger</i> IP 7 718 (a)	0	3.9×10^3	3.59	8.1×10	1.69	8.4×10	1.67

Notes:
 (1) number of germs (or spores)/ml at time $T = 0$, i.e. $[S]_{T=0}$
 (2) number of germs (or spores)/ml at time $T = 2$ h, i.e. $[S]_{T=2h}$
 (3) germicidal (or sporicidal) activity, i.e. $\Delta R = \log([S]_{T=0}) - \log([S]_{T=2h})$

TABLE IIb

Strain	(1)	Ex. 2 dilution: $\frac{1}{2}$		A2 dilution: $\frac{1}{2}$		B2 dilution: $\frac{1}{2}$	
		(2)	(3)	(2)	(3)	(2)	(3)
<i>Staphylococcus aureus</i> IP 52 154	1.9×10^6	0	6.27	0	6.27	0	6.27
<i>Pseudomonas aeruginosa</i> , IP A22	1.5×10^6	0	6.17	0	6.17	0	6.17
<i>Enterococcus faecium</i> IP 5 855	1.6×10^5	0	5.20	0	5.20	5	4.61
<i>Mycobacterium smegmatis</i> IP 7 326	1.4×10^5	0	5.14	0	5.14	10	4.14
<i>Candida albicans</i> IP 1180 79	1.9×10^5	0	5.27	5	4.58	10	4.27
<i>Penicillium verrucosum</i> IP 1186 79	1.5×10^5	0	5.17	2×10^2	2.87	2.3×10^2	2.81
spores of <i>Bacillus subtilis</i> var. <i>Niger</i> IP 7 718 (a)	3.9×10^3	0	3.59	4.8×10	1.91	5.1×10	1.89
<u>Notes:</u> (1) number of germs (or spores)/ml at time $T = 0$, i.e. $[S]_{T=0}$ (2) number of germs (or spores)/ml at time $T = 2$ h, i.e. $[S]_{T=2h}$ (3) germicidal (or sporicidal) activity, i.e. $\Delta R = \log([S]_{T=0}) - \log([S]_{T=2h})$							

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TABLE IIc

Strain	(1)	Ex. 3 dilution: 1/10		A3 dilution: 1/10		B3 dilution: 1/10	
		(2)	(3)	(2)	(3)	(2)	(3)
<i>Staphylococcus aureus</i> IP 52 154	2.1×10^6	10	5.32	1.1×10^2	4.28	1.2×10^2	4.25
<i>Pseudomonas aeruginosa</i> IP A22	1.4×10^6	10	5.14	3.5×10	3.60	3.7×10	3.58
<i>Enterococcus faecium</i> IP 5 855	1.3×10^5	0	5.11	10^2	3.11	1.7×10^2	2.88
<i>Mycobacterium smegmatis</i> IP 7 326	1.5×10^5	0	5.17	1.9×10^2	2.89	2.2×10^2	2.87
<i>Candida albicans</i> IP 1180 79	1.7×10^5	10	4.23	2.8×10^2	2.78	3.1×10^2	2.73
<i>Penicillium verrucosum</i> IP 1186 79	1.1×10^5	1.3×10	3.82	6.7×10^2	2.21	1.1×10^3	2.00
spores of <i>Bacillus subtilis</i> var. <i>Niger</i> IP 7 718 (a)	4.2×10^3	0	3.62	1.3×10^2	1.51	1.9×10^2	1.34
Notes: (1) number of germs (or spores)/ml at time $T = 0$, i.e. $[S]_{T=0}$ (2) number of germs (or spores)/ml at time $T = 2$ h, i.e. $[S]_{T=2h}$ (3) germicidal (or sporicidal) activity, i.e. $\Delta R = \log([S]_{T=0}) - \log([S]_{T=2h})$							

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TABLE II d

Strain	(1)	Ex. 4 dilution: 1/5		A4 dilution: 1/5		B4 - B1 dilution: 1/5	
		(2)	(3)	(2)	(3)	(2)	(3)
<i>Staphylococcus aureus</i> IP 52 154	2×10^6	0	6.30	0	6.30	0	6.30
<i>Pseudomonas aeruginosa</i> IP A22	1.5×10^6	0	6.17	2.11×10	4.85	2.1×10	4.85
<i>Enterococcus faecium</i> IP 5 855	1.6×10^5	0	5.20	1.1×10	4.16	9×10	3.25
<i>Mycobacterium smegmatis</i> IP 7 326	1.3×10^5	0	5.11	2.2×10	3.77	1.9×10	3.84
<i>Candida albicans</i> IP 1180 79	1.8×10^5	0	5.25	1.9×10	3.98	1.5×10	4.08
<i>Penicillium verrucosum</i> IP 1186 79	1.3×10^5	0	5.11	2.7×10^2	2.68	2.6×10^2	2.70
spores of <i>Bacillus subtilis</i> var. <i>Niger</i> IP 7 718 (a)	3.9×10^3	0	3.59	9×10	1.64	8.4×10	1.67

Notes:

- (1) number of germs (or spores)/ml at time $T = 0$, i.e. $[S]_{T=0}$
 (2) number of germs (or spores)/ml at time $T = 2$ h, i.e. $[S]_{T=2h}$
 (3) germicidal (or sporicidal) activity, i.e. $\Delta R = \log([S]_{T=0}) - \log([S]_{T=2h})$

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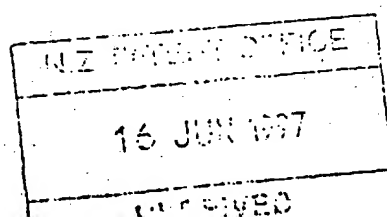
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TABLE IIe

Strain	(1)	Ex. 5 dilution: 1/10		A5 dilution: 1/10		B5 dilution: 1/10	
		(2)	(3)	(2)	(3)	(2)	(3)
<i>Staphylococcus aureus</i> IP 52 154	1.9×10^6	1.1×10	5.16	1.4×10^2	4.06	1.1×10^2	4.16
<i>Pseudomonas aeruginosa</i> IP A22	1.5×10^6	10	5.17	3.7×10	4.61	1.5×10	4.00
<i>Enterococcus faecium</i> IP 5 855	1.7×10^5	0	5.23	1.2×10^2	3.16	1.5×10^2	3.06
<i>Mycobacterium smegmatis</i> IP 7 326	1.3×10^5	0	5.11	2×10^2	2.51	1.7×10^2	2.88
<i>Candida albicans</i> IP 1180 79	1.9×10^5	2	4.97	3.1×10^2	2.00	3×10^3	2.80
<i>Penicillium verrucosum</i> IP 1186 79	1.5×10^5	1.1×10	4.13	6.6×10^2	2.36	10^3	2.17
spores of <i>Bacillus subtilis</i> var. <i>Niger</i> IP 7 718 (a)	4.1×10^3	0	3.61	1.4×10^2	1.47	1.8×10^2	1.36

Notes:

- (1) number of germs (or spores)/ml at time $T = 0$, i.e. $[S]_{T=0}$
 (2) number of germs (or spores)/ml at time $T = 2$ h, i.e. $[S]_{T=2h}$
 (3) germicidal (or sporicidal) activity, i.e. $\Delta R = \log([S]_{T=0}) - \log([S]_{T=2h})$



The results in Tables IIa to IIe show that (i) in contrast to compositions A1 - A5 and B1 - B5, the compositions according to the invention are all fungicidal towards strains of *Penicillium verrucosum*, irrespective of the dilution, and (ii) at a given dilution, the compositions according to the invention are always more effective than compositions A1 - A5 and B1 - B5. These results further illustrate the synergistic effect of the combination of H_2O_2 + RCO_2H/RCO_3H mixture + silver component.

Experiments II

The antiparasitic activity of the compositions according to the invention (Ex. 1 - Ex. 5) was studied using parasites responsible for schistosomiasis, namely strains of *Schistosoma haematobium* (bladder schistosomiasis) and of *Schistosoma mansoni* (intestinal schistosomiasis).

At time $T = 0$, 10 ml of the undiluted test compositions are introduced into flat-bottomed vessels of the Petri dish type, each containing 90 ml of nutrient medium and 8 to 10 parasite larvae. The number of live larvae is measured at time $T = 0.5$ h.

The results obtained are collated in Table III below:

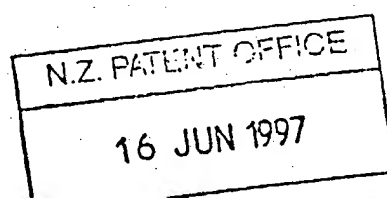


TABLE III

Product	Number of live larvae			
	<i>Schistosoma haematobium</i>		<i>Schistosoma mansoni</i>	
	T - 0	T - 0.5 h	T - 0	T - 0.5 h
Ex. 1	10	0	8	0
A1	10	3	8	2
B1	10	3	8	3
Ex. 2	10	0	8	0
A2	10	3	8	2
B2	10	3	8	2
Ex. 3	8	0	8	0
A3	8	2	8	2
B3	8	3	8	2
Ex. 4	8	1	8	0
A4	8	2	8	2
B4	8	2	8	2
Ex. 5	8	0	8	0
A5	8	2	8	2
B5	8	2	8	3

The results in Table III show on the one hand the value of compositions Ex. 1 - Ex. 5 according to the invention compared with compositions A1 - A5 and B1 - B5, and on the other hand the synergistic effect of the combination of H_2O_2 + RCO_2H/RCO_3H mixture + silver component.

Experiments III

Experiments were carried out according to French Standard AFNOR NF T 72 180 (as amended in December 1989) in order to assess the virucidal properties of the compositions according to the invention (Ex. 1 - Ex. 5) compared with the compositions of the prior art (A1 - A5 and B1 - B5). Briefly, the viral suspensions are brought into contact for 15, 30 and 60

minutes, at 20°C, with each test composition (i.e. "product") diluted with a phosphate buffer, and the titer of each viral suspension is then measured after the virucidal activity of said composition has been stopped by rapid dilution or, preferably, by molecular sieving. The controls received the phosphate buffer only.

Under these operating conditions, a test composition is said to be virucidal if it reduces the population of the virus in question by a factor of at least 10,000 (i.e. reduces the viral titer by a value of at least 4) compared with the control experiments.

The results obtained (mean of 5 measurements) are collated in Tables IVa, IVb and IVc below, the viral strains used being as follows:

Orthopoxvirus (vaccinia virus),

Adenovirus (human adenovirus type 5) and

Poliovirus (poliomyelitis virus 1, SABIN strain).

TABLE IVa

Viral strain: Orthopoxvirus

Product (dilution)	Viral titer, i.e. $\log([S]_{T-x})$			
	T - 0.25 h	T - 0.5 h	T - 1 h	Control T - 1 h
Ex. 1 (9/10)	≤ 2.34	≤ 2.34	≤ 2.34	7.82
A1 (9/10)	≤ 2.34	≤ 2.34	≤ 2.34	
B1 (9/10)	≤ 2.34	≤ 2.34	≤ 2.34	
Ex. 1 (1/2)	≤ 2.34	≤ 2.34	≤ 2.34	7.82
A1 (1/2)	5.21	≤ 2.34	≤ 2.34	
B1 (1/2)	6.12	4.15	≤ 2.34	
Ex. 1 (1/10)	3.14	≤ 2.34	≤ 2.34	7.82
A1 (1/10)	7.60	6.20	≤ 2.34	
B1 (1/10)	7.80	6.50	4.50	
Ex. 2 (9/10)	≤ 2.34	≤ 2.34	≤ 2.34	7.84
A2 (9/10)	≤ 2.34	≤ 2.34	≤ 2.34	
B2 (9/10)	≤ 2.34	4.15	≤ 2.34	
Ex. 2 (1/2)	≤ 2.34	≤ 2.34	≤ 2.34	7.84
A2 (1/2)	5.80	≤ 2.34	≤ 2.34	
B2 (1/2)	7.16	5.44	≤ 2.34	
Ex. 2 (1/10)	3.36	≤ 2.34	≤ 2.34	7.84
A2 (1/10)	7.76	7.15	≤ 2.34	
B2 (1/10)	7.81	7.22	5.25	

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TABLE IVa (end)

Viral strain: Orthopoxvirus

Product (dilution)	Viral titer, i.e. $\log([S]_{T-x})$			
	T - 0.25 h	T - 0.5 h	T - 1 h	Control T - 1 h
Ex.3 (1/2)	≤ 2.34	≤ 2.34	≤ 2.34	7.83
A3 (1/2)	5.88	3.30	≤ 2.34	
B3 (1/2)	7.50	6.20	≤ 2.34	
Ex. 3 (1/10)	3.42	≤ 2.34	≤ 2.34	7.83
A3 (1/10)	7.80	7.40	3.27	
B3 (1/10)	7.82	7.30	5.60	
Ex. 4 (1/2)	3.41	≤ 2.34	≤ 2.34	7.82
A4 (1/2)	7.30	5.50	4.36	
B4 (1/2)	6.12	4.15	≤ 2.34	
Ex. 4 (1/10)	3.31	≤ 2.34	≤ 2.34	7.82
A4 (1/10)	7.79	7.20	5.10	
B4 (1/10)	7.80	6.50	4.50	
Ex. 5 (1/10)	3.29	≤ 2.34	≤ 2.34	7.83
A5 (1/10)	7.60	7.09	4.27	
B5 (1/10)	7.71	6.41	3.80	

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TABLE IVb

Viral strain: Adenovirus

Product (dilution)	Viral titer, i.e. $\log([S]_{T-x})$			
	T = 0.25 h	T = 0.5 h	T = 1 h	Control T = 1 h
Ex. 1 (9/10)	≤ 2.34	≤ 2.34	≤ 2.34	7.07
A1 (9/10)	4.66	4.35	4.06	
B1 (9/10)	4.41	4.04	3.71	
Ex. 1 (1/2)	≤ 2.34	≤ 2.34	≤ 2.34	7.07
A1 (1/2)	5.52	4.90	4.71	
B1 (1/2)	2.74	≤ 2.34	≤ 2.34	
Ex. 1 (1/10)	2.74	≤ 2.34	≤ 2.34	0.07
A1 (1/10)	7.17	5.98	5.36	
B1 (1/10)	6.26	5.49	5.05	

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TABLE IVc

Viral strain: Poliovirus

Product (dilution)	Viral titer, i.e. $\log([S]_{T-x})$			
	T = 0.25 h	T = 0.5 h	T = 1 h	Control T = 1 h
Ex. 1 (9/10)	≤ 2.34	≤ 2.34	≤ 2.34	8.44
A1 (9/10)	6.20	5.49	5.11	
B1 (9/10)	6.12	5.38	4.82	
Ex. 1 (1/2)	≤ 2.34	≤ 2.34	≤ 2.34	8.44
A1 (1/2)	6.97	6.31	5.72	
B1 (1/2)	6.63	5.47	5.14	
Ex. 1 (1/10)	3.64	2.81	≤ 2.34	8.44
A1 (1/10)	7.59	7.40	6.37	
B1 (1/10)	7.41	7.29	6.22	

The results in Tables IVa, IVb and IVc show that (i) only the compositions according to the invention are virucidal at the dilutions used (9/10, 1/2 and 1/10) and for the contact times used (0.25 h, 0.5 h and 1 h), and (ii) for a given dilution and a given contact time, the compositions according to the invention are generally more active than the compositions of the prior art.

Experiments IV

Complementary experiments were carried out on experimental farms (on the one hand a banana plantation contaminated by banana canker, *Colletotrichum musae*, and on the other hand an orchard contaminated by apple canker, *Nectria galligena*) with the compositions according to the invention (Ex. 1 - Ex. 5) administered by spraying.

This treatment made it possible to save the diseased trees and effectively to protect the healthy trees.

05 Other experiments, carried out on harvests stored in silos or small wooden vats (cereals, tomatoes and dessert grapes in particular), were also able to demonstrate protection of said harvests from the customary germs which damage them.

Experiments V

10 Experiments were carried out with the composition of Example 6 as a hygiene product for the decontamination of balneotherapy baths, using customary hospital bacterial strains (*Pseudomonas aeruginosa*, *Pseudomonas cepacia*, *Enterobacter agglomerans*, *Enterobacter cloacae*, *Escherichia coli*, *Staphylococcus cohnii*, *Staphylococcus aureus*). It was found that, at
15 a final use dilution of $5/10^7$, the composition of Example 6 used in this way has an effective bacteriostatic effect for at least 48 h. At the same final
20 dilution, the comparative compositions, lacking either the component AgNO_3 or the mixture of $\text{CH}_3\text{CO}_2\text{H} + \text{CH}_3\text{CO}_2\text{H}$, proved ineffective.

25 The following experiments VI - IX are pollution control experiments carried out with dilutions of the stock composition of Example 7 and, if appropriate, the analogous compositions A7 (without AgNO_3) and B7 (without the mixture of $\text{CH}_3\text{CO}_2\text{H} + \text{CH}_3\text{CO}_2\text{H}$).

Experiments VI

30 Experiments were carried out on soils typical of the mining industry, collected in a stockyard of mining residues belonging to the Canadian company IRON ORES, soil no. 1 originating from an abandoned iron pellet works and soil no. 2 having been taken near a shut-down conveyor. The effect of diluting Ex. 7, A7
35 and B7 on the growth or inhibition of the heterotrophic

bacteria extracted from these two soils was evaluated.

The microorganisms were extracted from each soil (5 g) with a sterile saline solution (50 ml) containing 0.85% w/v of NaCl. The resulting extract was diluted seven times in succession (1/10 dilutions). A volume of 1 ml of the extract and of each dilution was placed in a 15 ml test tube containing 8 ml of culture medium (nutrient broth at a concentration of 8 g/l) and 1 ml of a dilution (1/100, 1/10,000, 1/100,000 or 1/1,000,000) of the composition of Ex. 7, A7 or B7. The tubes were incubated at 30°C for 3 days, the control batch receiving no test product (i.e. dilution of Ex. 7, A7 or B7).

The results obtained (means of five experiments per test composition and per test dilution) are collated in Table V below.

TABLE V

Inhibition of the heterotrophic bacteria

Product (dilution)	Total heterotrophs/g of dry soil	
	in soil no. 1	in soil no. 2
Controls	5×10^5	5×10^6
Ex. 7 (1/10 ⁶)	5×10^5	3×10^6
A7 (1/10 ⁶)	5×10^5	5×10^6
B7 (1/10 ⁶)	5×10^5	5×10^6
Ex. 7 (1/10 ⁵)	2×10^5	2×10^6
A7 (1/10 ⁵)	5×10^5	5×10^6
B7 (1/10 ⁵)	5×10^5	5×10^6
Ex. 7 (1/10 ⁴)	<10	10^2
A7 (1/10 ⁴)	10	10^6
B7 (1/10 ⁴)	3×10^5	3×10^6
Ex. 7 (1/10 ²)	<10	<10
A7 (1/10 ²)	5×10^3	6×10^3
B7 (1/10 ²)	8×10^3	10^4

Table V shows that Ex. 7 is very effective at dilutions of $1/10^4$ and $1/10^2$ whereas A7 and B7 are unusable at the same dilutions.

Experiments VII

05 Experiments were carried out to study the inhibition of a pure strain of *Thiobacillus ferro-*
oxidans (ATCC 13661) in a liquid $(\text{NH}_4)_2\text{SO}_4$ medium
containing 0.5 g/l of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.5 g/l of K_2HPO_4 ,
10 33.4 g/l of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ and H_2SO_4 (to adjust the pH to 2.2).

1 ml of the suspension of the pure strain of *Thiobacillus ferrooxidans* (ATCC 13661), 8 ml of the nutrient medium and the dilution of the composition of Ex. 7 (at final dilutions of $1/10^6$, $1/10^5$, $1/10^4$ and
15 $1/10^3$) are introduced into a test tube. The results obtained (means of 5 experiments per dilution) are collated in Table VI below, the control product not containing the dilution of Ex. 7.

20 TABLE VI

Inhibition of *Thiobacillus ferrooxidans*

Product (dilution)	Number of <i>Thiobacillus ferrooxidans</i> /100 ml
Control	7×10^7
Ex. 7 ($1/10^6$)	7×10^7
Ex. 7 ($1/10^5$)	5×10^7
Ex. 7 ($1/10^4$)	10^3
Ex. 7 ($1/10^3$)	<10

30 The results in the Table show that, at the final concentration, Ex. 7 is particularly effective for inhibiting *Thiobacillus ferrooxidans* at dilutions of $1/10^4$ and particularly $1/10^3$. In these experiments,
35 the initial bacterial population (7×10^7 germs/100 ml)

was very considerably greater than the bacterial population normally encountered in soils in the mining industry (10^4 to 10^5 germs/l).

Experiments VIII

05 Experiments were carried out to assess the efficacy of Ex. 7 in the oxidation of cyanides in two soils: a sterilized soil consisting of sand poor in organic matter, and a sterilized soil consisting of
10 sand and organic matter (hereafter denoted as "organic soil"). These sterile soils were contaminated with KCN to give a final concentration of 100 mg of CN^- per kg of soil.

15 CuSO_4 is incorporated as an oxidation catalyst into a dilution (1/1000, 1/100 or 1/10) of the composition of Example 7 (so as to give a final concentration of 20 mg of Cu^{2+} per kg of soil). 5 ml of each dilution of Ex. 7, complemented with Cu^{2+} , are added to 100 g of contaminated soil, the final dilution of Ex. 7 being 0.005, 0.5 or 5 ml of Ex. 7 per kg of soil. The
20 soils treated in this way are left to stand for 4 h at room temperature ($10-25^\circ\text{C}$), after which the cyanide concentration remaining in each soil is measured.

The results obtained have been collated in Table VII below.

TABLE VII

Cyanides remaining in the soils

Ex. 7 (ml/kg)	Total cyanides remaining (mg/kg)	
	sand	organic soil
0	27 ± 2	10 ± 0.5
0.005	21 ± 7	8.5 ± 1
0.5	3 ± 0.2	8.1 ± 0.5
5	(a)	4.3 ± 1.2

The results in Table VII show that the cyanide concentrations in the untreated soils were found to be lower than the initial concentration incorporated. This explains that other cyanide-eliminating mechanisms have taken place (atmospheric oxidation, evaporation, etc.). Said results further show that the cyanide concentration remaining in the organic soil is lower than that remaining in the sand, which is explained (i) by the fact that the pH of the sand (6.8) is different from that of the organic soil (7.4), a basic environment being more favorable to the oxidation of cyanides, and (ii) by the fact that the organic matter was able to oxidize the cyanides.

Experiments IX

Complementary experiments were carried out to assess whether or not the cleaning composition according to the invention, which inhibits the strains of *Thiobacillus ferrooxidans*, has an unfavorable effect as regards acid generation because of the presence of H_2O_2 .

A sludge originating from a waste water treatment plant, containing a high population of *Thiobacillus ferrooxidans* and having a solids content of 20% w/v, was acidified to pH 4.0 with sulfuric acid. 75 ml samples of this sludge were placed in 250 ml flasks. Half of these flasks were sterilized to kill the bacteria present. 5 ml of various dilutions of Ex. 7 were then introduced into each flask to give final dilutions of $1/10^6$, $1/10^5$, $1/10^4$, $1/10^3$ and $1/10^2$. All the flasks were shaken (orbital shaker at 150 rpm) at 28°C for 4 days. The pH was then measured in each flask.

The results obtained (means of 2 experiments) have been collated in Table VIII below.

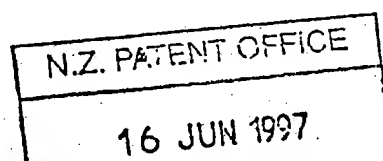


TABLE VIII

Evaluation of pH of sludges

Dilution of Ex. 7	pH in sterile sludges (without <i>Thiobacillus ferrooxidans</i>)	pH in sludges containing <i>Thiobacillus ferrooxidans</i>
0	3.3	2.6
1/10 ⁶	3.3	2.7
1/10 ⁵	3.3	2.7
1/10 ⁴	3.3	2.9
1/10 ³	3.2	3.0
1/10 ²	2.7	2.7

As regards the sludges not containing *Thiobacillus ferrooxidans* (sterilized sludges), the results in Table VIII show that (i) the pH of the sludges decreased from 4.0 to 3.3 in the absence of Ex. 7, indicating that chemical reactions, such as the natural oxidation of Fe^{2+} by atmospheric oxygen, have taken place, (ii) at a final dilution less than or equal to 1/10⁴, Ex. 7 has no influence on the pH, and (iii) at a dilution of 1/10³, on the other hand, Ex. 7 induces acid generation.

As regards the sludges containing *Thiobacillus ferrooxidans*, the results in Table VIII show that (i) with the exception of Ex. 7 at a final dilution of 1/100, the pH dropped to lower values than those measured in the previously sterilized samples for an identical concentration of Ex. 7, indicating a growth of *Thiobacillus ferrooxidans*, (ii) the pH drops in proportion with the concentration of Ex. 7 (i.e. the number of bacteria decreases when the concentration of Ex. 7 increases), and (iii) at a final dilution of 1/100, Ex. 7, which should prevent the pH from dropping, induces acid generation.

In conclusion, the result of these experiments

is that Ex. 7 has to be used at a final dilution of less than 1/100 in order to avoid the effect of acid generation, a final dilution of 1/1000 being perfectly suitable.

05 **Synergistic effect**

The interaction of the combination of H_2O_2 + silver component + CH_3CO_2H/CH_3CO_2H mixture was assessed using the method described by R.F. SCHINAZI et al., Antimicrob. Agents Chemother., 22 (no. 3), pages 499-10 507 (1982), and improved by J.C. POTTAGE, *ibidem*, 30 (no. 2), pages 215-219, (1986), and in WO-A-91/13626, taking the following definitions into account:

IT_s = infectious titer of the stock of strains used,

15 IT_A = infectious titer of product A (in this case H_2O_2 + CH_3CO_2H/CH_3CO_2H mixture) brought into contact with said stock,

IT_B = infectious titer of product B (in this case H_2O_2 + silver component) brought into contact with said stock,

20 T_{AB} = infectious titer of product A + B (in this case H_2O_2 + CH_3CO_2H/CH_3CO_2H mixture + silver component) brought into contact with said stock,

$S = \log IT_s,$

$A = \log IT_A,$

25 $B = \log IT_B,$

$C = \log IT_{AB},$

$Y_A = A/S = \log IT_A / \log IT_s,$

$Y_B = B/S = \log IT_B / \log IT_s,$

$Y_{AB} = C/S = \log IT_{AB} / \log IT_s,$ and

30 $Y_C = \text{product of } Y_A \times Y_B.$

There is a synergistic effect if $Y_{AB} \leq Y_C.$

On the basis of these definitions, when the values given in Table IVa are taken, for example, the comparison of the values of Y_{AB} and Y_C given in Table IX below is obtained.

Said Table IX shows that, at a final dilution of 1/10, the mixture of essential constituents of Ex. 1 - Ex. 5 has a synergistic effect relative to A1 - A5 and B1 - B5, respectively, towards the viral strain of Orthopoxvirus since Y_{AB} is less than or equal to Y_C .

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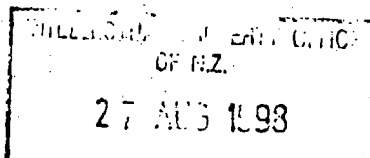
TABLE IX

Synergistic effect towards Orthopoxvirus at a dilution of 1/10

Products	S	A	B	C	Y_A	Y_B	Y_{AB}	Y_C
Ex. 1, A1, B1 (T = 0.25 h)	7.82	7.60	7.80	≤ 2.34	0.97	0.99	≤ 0.29	0.96
Ex. 2, A2, B2 (T = 0.25 h)	7.84	7.76	7.81	3.36	0.98	0.99	0.42	0.97
Ex. 3, A3, B3 (T = 1 h)	7.83	3.27	5.60	≤ 2.34	0.41	0.71	≤ 0.29	0.29
Ex. 4, A4, B4 (T = 0.5 h)	7.82	7.20	6.50	≤ 2.34	0.92	0.83	≤ 0.29	0.76
Ex. 5, A5, B5 (T = 0.5 h)	7.83	7.09	6.41	≤ 2.34	0.90	0.81	≤ 0.29	0.72

WHAT IS CLAIMED IS:

1. An aqueous decontaminating composition, said composition, which contains H_2O_2 and a silver component in an acid medium, comprising
 - (A) an amount of H_2O_2 less than or equal to 60% by weight, based on the total weight of said composition;
 - (B) an RCO_2H/RCO_2F mixture, where R is methyl or ethyl, said mixture being present in an amount such that the weight ratio of said mixture to the hydrogen peroxide is between 0.15/1 and 0.85/1;
 - (C) a silver component as a source of Ag^+ ions, selected from the group consisting of silver salts and complexes, said silver component being present in an amount such that the weight ratio of said silver component to the hydrogen peroxide is between 0.0005/1 and 0.015/1;
 - (D) a stabilizer present in an amount such that the weight ratio of said stabilizer to the hydrogen peroxide is between 0.0005/1 and 0.025/1; and water to make up to 100% by weight.
2. A composition according to claim 1 which also comprises at least one component selected from the group consisting of
 - (E) a surfactant;
 - (F) a corrosion inhibitor; and
 - (G) a fragrance.
3. A composition according to claim 1 or claim 2 wherein the weight ratio of the silver component to the hydrogen peroxide is between 0.0008/1 and 0.005/1.
4. A composition according to any one of claims 1-3, wherein the weight ratio of the stabilizer to the hydrogen peroxide is between 0.0008/1 and 0.005/1.



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5. A composition according to claim 1 which also comprises
 - (E) a surfactant in an amount such that the weight ratio of said surfactant to the hydrogen peroxide is between 0.00005/1 and 0.01/1;
 - (F) a corrosion inhibitor in an amount such that the weight ratio of said corrosion inhibitor to the hydrogen peroxide is between 0.00005/1 and 0.03/1;
and/or
 - (G) a fragrance in an amount less than or equal to that of the above corrosion inhibitor.
6. A composition according to claim 5, wherein the weight ratio of the surfactant to the hydrogen peroxide is about 0.005/1.
7. A composition according to claim 6 or claim 7, wherein the weight ratio of the corrosion inhibitor to the hydrogen peroxide is between 0.001/1 and 0.005/1.
8. A composition according to claim 1 which comprises
 - (A) 1.5 to 8% by weight of H_2O_2 ;
 - (B) 0.75 to 5.6% by weight of a mixture of RCO_2H and RCO_2H , where R is ethyl or, methyl;
 - (C) 0.0012 to 0.04% by weight of a silver component selected from silver complexes and salts as a source of Ag^+ ions;
 - (D) 0.0012 to 0.04% by weight of H_3PO_4 ;
 - (E) if appropriate, 0.0075 to 0.04% by weight of surfactant;
 - (F) if appropriate, 0.003 to 0.04% by weight of corrosion inhibitor;
 - (G) if appropriate, a fragrance; and
water to make up to 100% by weight.
9. A composition according to claim 8, wherein R is methyl.
10. A composition according to claim 1 or 8 which contains
 - (A) 7.5-8% by weight of H_2O_2 ;
 - (B) 4.5 to 4.8% by weight of a mixture of CH_3CO_2H + CH_3CO_2H ;
 - (C) 0.008% by weight of $AgNO_3$;
 - (D) 0.008% by weight of H_3PO_4 ; and
water to make up to 100% by weight.
11. A method of preparing an aqueous decontamina-

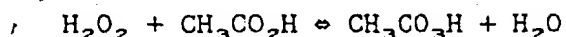
ting composition according to claim 1, said method comprising steps consisting in

- (1°) preparing an aqueous solution of the silver component which is present as a source of Ag^+ ions;
- (2°) introducing the stabilizer into said resulting solution obtained in this way;
- (3°) introducing said resulting solution obtained in this way into the hydrogen peroxide solution or introducing the hydrogen peroxide solution into said resulting solution;
- (4°) introducing, into said resulting solution obtained in this way, an acid substance selected from the group consisting of RCO_3H , RCO_2H and mixtures thereof, i.e. $\text{RCO}_3\text{H} + \text{RCO}_2\text{H}$;
- (5°) leaving said resulting solution obtained in this way until the equilibrium $\text{H}_2\text{O}_2 + \text{RCO}_2\text{H} \rightleftharpoons \text{RCO}_3\text{H} + \text{H}_2\text{O}$ has been established; and
- (6°) making up to 100% by weight with water.

12. A method according to claim 11 for the preparation of an aqueous decontaminating composition containing 7.5 to 8% by weight of H_2O_2 according to claim 10, said method comprising steps consisting in

- (1°) preparing a solution of AgNO_3 in part of the total amount of water required to produce said aqueous disinfecting composition;
- (2°) introducing, into the resulting solution obtained in this way, an aqueous solution of phosphoric acid containing 85% by weight of H_3PO_4 ;
- (3°) introducing the resulting solution obtained in this way into an aqueous solution of hydrogen peroxide containing 50 to 60% by weight of H_2O_2 , with stirring, at a temperature of between 0°C and 25°C , and with introduction of the solution obtained in step (2°) at a rate of between 3 and 6.1/h;

- (4°) introducing the acid substance $\text{CH}_3\text{CO}_2\text{H}$ into the resulting solution obtained in this way, with stirring, at a temperature of between 0°C and 25°C and with introduction of the acid substance $\text{CH}_3\text{CO}_2\text{H}$ at the rate of between 3 and 6 l/h;
- (5°) leaving the resulting solution obtained in this way to stand for 48 h, in the dark, at a temperature of between 0°C and 25°C , so that the equilibrium



is established; and

- (6°) adding the remaining water to make up to 100% by weight.
13. A method according to claim 12, wherein the temperature in step (3°) is between 4°C and 15°C .
14. A method according to claim 12 or claim 13, wherein the temperature in step (4°) is between 4°C and 15°C .
15. A method according to any one of claims 12-14, wherein the temperature in step (5°) is between 4°C and 15°C .
16. Use of a composition according to any one of claims 1 to 10 for the disinfection or hygiene of enclosed spaces, surfaces of various materials, instruments, foodstuffs, harvests, outdoor or greenhouse crops, storage containers, pipelines and drinking water, said use comprising
- (i) a surface or volume treatment of the product to be disinfected or decontaminated, at a temperature of between 0°C and 50°C , with said aqueous disinfecting composition, optionally diluted, and then
- (ii) if appropriate, drying of said product treated in this way.
17. Use according to claim 16, wherein the surface or volume treatment of the product to be disinfected or decontaminated is at room temperature (RT) within the range 10°C to 25°C .
18. Use of a composition according to any one of claims 1 to 10 for cleaning industrial mining sites in order to prevent acid generation and/or to destroy cyanides.

19. A composition according to claim 1, substantially as herein described with reference to any one of the Examples or with reference to any one of the Experiments.
20. A composition according to any one claims 1-10, substantially as herein described.
21. A method according to claim 11, substantially as herein described with reference to any one of the Examples.
22. A method according to any one of claims 11-15, substantially as herein described.
23. Use according to claim 16 or claim 18, substantially as herein described with reference to any one of the Experiments thereof.
24. Use according to any one of claims 16-18, substantially as herein described.

END OF CLAIMS

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